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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/625,501 | 07/22/2003 | Wendell Rhine | 46775 (57626) | 8091 |

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EDWARDS & ANGELL, LLP
P.O. BOX 55874
BOSTON, MA 02205

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| EXAMINER |
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HAMPTON HIGHTOWER, PATRICIA

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| ART UNIT | PAPER NUMBER |
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1711

DATE MAILED: 05/20/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/625,501

Applicant(s)

RHINE ET AL.

Examiner

Patricia Hightower

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 January 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) See Continuation Sheet is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3, 8-11, 13-15, 19-22, 24, 40-42, 46-52, 54, 56-64, 104-106, 108, 110 and 111 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 January 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Continuation of Disposition of Claims: Claims pending in the application are 1-3.8-11.13-15,19-22,24,40-42,46-52,54,56-64,104-106,108,110,111.

Response to Amendment

In view of the applicants' amendment/response filed January 10, 2005, the objection to the claims as being improper multiple dependent claims has been withdrawn. Further, the rejection of the claims under 35 USC 102(b) as anticipated by Suzuki et al (USP 6,399,669) has been withdrawn due the applicants amending the claims to define the diamine monomer as an aliphatic diamine, a bis(ω -aminoalkyl)-terminated polysiloxane has been withdrawn.

However, the claims 1-3, 8-11, 13-15, 19-22, 40-42, 46-52, 54, 56-64, 104-106, 108 and 110-111 are subject to a new ground under 35 USC 103(a) as being obvious over Suzuki et al (USP 6,399,669 of record) in view of Barringer et al (USP 5,234,966) taken with Mayer et al (USP 6,332,990) - both newly cited & of record.

Claims 47-48 are subject to a new ground of rejection under 35 USC 112, second paragraph, necessitated by applicants' amendment. Claim 52 is subject to a new ground of objection under 37 CFR 1.75(c) as being of improper dependent form.

The cancellation of claims 4-7, 12, 16-18, 23, 25-38, 43-45, 53, 55, 65-103, 107 and 109 in the amendment/response filed January 10, 2005 is acknowledged; claims 1-3, 8-11, 13-15, 19-22, 40-42, 46-52, 54, 56-64, 104-106, 108 and 110-111 are presently pending.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 47-48 are newly rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 47 and 48 the applicants have not defined the subscript "x".

Clarification is requested.

Claim 42 is newly objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. It depends upon cancel claim 43.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3,8-11,13-15,19-22,24,40-42,46-52,54,56-54,104-106,108,110 and 111 are newly rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al (USP 6,399,669 of record) in view of Barringer et al (USP 5,234,966) taken with Mayer et al (USP 6,332,990) – both newly cited & of record.

Suzuki et al (USP 6,399,669) discloses a porous material made of a dry gel of a polyimide resin having an apparent density of 800Kg/m³ or less and a mean pore size of

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1 μm or less, the porous material exhibits high heat resistance and is low in density and mean pore size; said porous polyimide material is used to produce not only a heat insulator with a low thermal conductivity and high heat insulation but also an insulating material having a low dielectric constant and exhibiting excellent dielectric characteristics at high frequencies, it can also provide a semiconductor circuit including the insulating material. See abstract; col. 2, lines 5-67; col. 3, lines 3-7, 10-20, 25-32, 33-40, 41-68; col. 4, lines 29, 30-53, 58-67; col. 5, lines 1-21, 22-67; col. 6, lines 1-67; col. 7, lines 1-26, 28-31, 32-67; col. 8, lines 1-67; col. 9, lines 15-21, 36-45, 49-60, 61-67; col. 10, lines 3-13, 14-32, 44-50, 52-56, 59-67; Examples 1-6; Claims 1-6.

At col. 14, example 5, the patentee teaches the polyimide resin sheet was immersed in a methanol/water mixed solvent and heated at 50°C for 1 day which gave a polyimide swollen body. The swollen body was further heat treated for 7 days to make a gel. The polyimide wet gel thus obtained, was subjected to supercritical drying using carbon dioxide which gave a polyimide dry gel. The dry gel thus produced had an apparent density of about 500 kg/m³, mean pore size of about 700 nm and a BET specific surface area of about 450 m²/g. Next, the polyimide dry gel carbonized at 800°C in a nitrogen atmosphere to produce a porous carbon material.

At col. 6, lines 54-62 the polyimide resin is synthesized by condensation reaction of a compound such as an aromatic or aliphatic tetracarboxylic dianhydride (hereinafter referred to as compound "a") with a compound such as an aromatic or aliphatic diamine (hereinafter referred to as compound "b"). Therefore, a polyamide acid/polyimide precursor is synthesized by condensation of the compounds "a" and "b". The polyimide

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precursor can be processed into a sheet because it is soluble in any organic solvent.

See col. 7, lines 10-27,28-31, the patentee recites the compound "a" and

"b"/dianhydride and diamine used to prepare the polyamic acid and the resulting

polyimide are not limited to the examples disclosed and any compounds may be used, if their combination can form a resin having a polyimide structure.

At col. 7, lines 45-67 the patentee teaches the polyimide precursor obtained in Step A-1 imidized by heating or chemical treatment with a dehydrated solvent such as acetic anhydride or pyridine to form a polyimide. Suzuki teaches at col. 5, lines 43-46,53-67; col. 6, lines 1-5,6-10,34; col. 7, lines 45-55,62-67; col. 8, lines 1-3,13-17,34-45; col. 9, lines 16-21,28-45,49-67; col. 10, lines 39-67; col. 11, lines 1-3,8-23; the method for producing a porous material can be classified into two types. One type method contains the processes A, B and C. The other type method contains the process D. Suzuki teaches at col. 10, lines 57-61, Process D is also the same as Process B except that the order of the steps of imidization and drying is reversed. The polyimide dry gel obtained by any of Processes A to D can be used as a porous material as it or otherwise may be formed into a carbon material by carbonization. The resulting carbon material can be used as a porous material.

The patentee teaches at col. 6, lines 13-43, the method for producing a porous material contains Process D. Process D obtains a solution or swollen body of a polyimide precursor and then gels them to form a wet gel of the polyimide precursor. Subsequently, the resultant wet gel is dried to obtain a dry gel. Then, the dry gel is imidized to obtain a dry gel of a polyimide resin. Process D is characterized in that it

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permits preformation of a skeleton of the resultant porous materials by the polyimide precursor because the polyimide precursor is readily soluble in the solvent, facilitating production operation of the porous material. Process D is particularly effective for obtaining a polyimide resin that is hardly soluble in a solvent. In Process D, drying by heating is suited for a final step of imidization an imide in order to prevent dry gel from being wetted again. If production of a porous material comprising a carbon material is intended, then the process further includes a step of carbonizing the dry gel of the polyimide resin obtained by heating. Carbonization should be performed in a vacuum or an inert gas atmosphere in order to prevent the dry gel from being burnt during carbonization. A simple method of baking the dry gel in an inert gas atmosphere such as nitrogen or argon at 500°C or higher is preferred. Temperatures of 500°C or higher can accelerate carbonization, the heating temperature should be 800°C or higher, preferably 1,000°C or higher. An upper limit of heating temperature may be about 1500°C, because the carbonization may proceed effectively.

Suzuki teaches at col. 9, lines 16-25,28-45,49-60; the dry step for obtaining a dry gel from the wet gel can be performed using any routine drying method such as natural drying, drying by heating or drying under reduced pressure, **supercritical drying** method or freeze- drying method. The use of **supercritical drying** or freeze-drying method prevents shrinkage of the gel during drying. **Supercritical drying** and freeze-drying are **suitable drying methods for producing a low dense porous dry gel, because they allow drying the wet gel with no risk of stress on the gel skeleton due to surface tension by eliminating liquid-gas interface, thereby preventing the**

gel from shrinking during drying. The dry gel obtained by the supercritical drying method is particularly called an “aerogel”. The solvent (exemplary solvents, **alcohols** such as methanol, ethanol and isopropanol and **carbon dioxide all which directly change the solvent into a supercritical fluid**) to be used for the supercritical drying method can be the same as that used for the wet gel. Suzuki teaches the supercritical drying should be performed in a pressed vessel such as autoclave. When the solvent is methanol, for example, supercritical drying should be done under supercritical conditions of methanol, that is, a pressure of 8.09 MPa and a temperature of 239.4°C or higher by gradually releasing the pressure while holding the temperature constant. When the solvent is carbon dioxide, supercritical drying should be done under supercritical conditions of carbon dioxide, that is a pressure of 7.38 MPa and a temperature of 31.1°C or higher by releasing the pressure in the supercritical state of carbon dioxide to make it gaseous while holding the temperature constant.

However, Suzuki differs in not teaching as claimed the process of producing a polyimide aerogel wherein a reinforcing agent is added to the wet polyimide wet gel before drying with supercritical CO₂, wherein the reinforcing agent is selected from a reinforcement pad, organic & inorganic fibers, carbon nanotubes, metallic fillers or particles, inorganic fillers or particles; nor the diamine component being an amino terminated polysiloxane and the use of the polyimide aerogel in electrochemical applications.

Barringer et al (USP 5,234,966 – newly cited) teaches a polyimide foam of a desired density produced by adding to a polyimide precursor comprising carboxylic acid

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and diamine components at least one foam-enhancing polar, protic additive; preferably the tetracarboxylic components are esters, and the primary polyamine components employed are preferably aromatic diamines, heterocyclic diamine or combinations thereof, optionally with a minor proportion of one or more aliphatic diamines, in addition to the aliphatic amines, use can be made of aliphatic etherified polyamine such as polyoxypropylene amines and other useful primary diamines that may be included in the polyimide precursor include amino-terminated ***aromatic aminoterminated silicones***.

See col. 5, lines 54- col. 6, lines 1-16,42-56; col. 2, lines 1-21,35-68; abstract.

Barringer et al (USP 5,234,966 – newly cited) teaches at col. 7, lines 50-56, the polyimide precursor may also contain various filler and/or reinforcing materials. For example, graphite, glass and other synthetic fibers can be added to the precursor composition to produce a fiber-reinforced product.

Mayer et al (USP 6,332,990 – newly cited & of record) teaches carbon aerogels used as a binder for granularized materials including other forms of carbon and metal additives, are cast onto carbon or metal fiber substrates to form composite carbon thin film sheets, the thin film sheets are utilized in electrochemical energy storage applications, such as electrochemical double layer capacitors (aerocapacitors), fuel cell electrodes, lithium based battery insertion electrodes and electrocapaitive deionization electrodes. The composite carbon foam may be formed by prior known processes, but with the solid particles being added during the liquid phase of the process, i.e., gleton. The other forms of carbon may include carbon microspheres, carbon powder, carbon aerogel powder or particles, graphite carbons. Metal and/or carbon fibers may be

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added for increased conductivity. See abstract; col. 1, lines 15-20,46-56,66-67; col. 2, lines 1-3,5-10,15-34; col. 6, lines 20-29,47-65; col. 7, lines 1-25; claims 1-10.

Mayer et al teaches the electrical conductivity of the composite aerogels are dependent on the composition of the materials utilized, particularly the composition of the added solid granularized or microsphere materials. While the microspheres or solid particles of carbon foams and other forms of carbon, will increase the electrical conductivity, metal and/or carbon may include nickel, stainless steel, aluminum, carbon, electroplated carbon fiber, etc. See col. 6, lines 20-29.

In view of the teaching of Barringer that a mixture of diamines could be used in preparing the polyimide precursor including aromatic, aliphatic and aromatic amino terminated silicones; and the teaching of Mayer of carbon aerogels used as binders for granularized materials such as carbon and metal fibers are cast onto carbon or metal fiber substrates to form composite carbon thin film sheets useful in electrochemical applications, wherein the metal and carbon fibers are added to increase the conductivity. It would have been prima facie obvious to include a silicon containing diamine in the diamine component used to prepare the polyimide precursor used to prepare porous materials made of a dry gel of a polyimide resin as taught by Suzuki et al and to increase the conductivity of the porous material prepared from the a dry gel of a polyimide to incorporate granularized materials such as carbon and metal fibers as taught by Mayer et al useful in electrochemical applications; thereby arriving at the invention as claimed.

Applicant's arguments with respect to claims 1-3,8-11,13-15,19-22,24,40-42,46-52,54,56-64,104-106,108,110 and 111 have been considered but are moot in view of the new ground(s) of rejection.

Prior Art

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. These references are cited to show the state of the art of methods of forming composite articles, polyimide aerogels, carbon aerogels, conductive pyrolyzed dielectrics and articles prepared therefrom and methods of removing low molecular weight substance from polyimide precursor or polyimides, Loszewski, Eastman and Kanada.

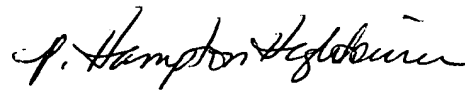
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patricia Hightower whose telephone number is (571) 272-1073. The examiner can normally be reached on M-F from 9:30 A.M. - 6:00 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, James Seidleck can be reached on (571) 272-1078. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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A handwritten signature in black ink, appearing to read "P. Hampton Hightower". The signature is fluid and cursive, with the first name "P." being small and the last name "Hightower" being larger and more prominent.

P. Hampton Hightower
Primary Examiner
Art Unit 1711

P. Hightower: ph
March 19, 2005